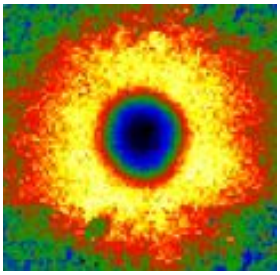

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Research on Epitaxial Growth of III-V Nitride and Transition Metal Nitride Materials for Optoelectronic Applications

The Nobel Prize awarded to Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura in 2014 propelled III-Nitride semiconductors into the spotlight, marking the advent of third-generation semiconductors and sparking a revolution in lighting. My studies from graduate to post-PhD explored the multiple applications of III-Nitride materials, including solar cells, bio-sensing, and the realization of surface plasmonic-enhanced UV lasing on periodic GaN nanorod arrays. Another research topic revolves around refractory metallic nitride, with a specific focus on titanium nitride (TiN). Leveraging its high-temperature durability, unique optical properties, and large electrical tunability, I aim to grow high-quality crystalline ultrathin TiN film and fabricate nanopatterned plasmonic surfaces. These surfaces have potential applications in thermal photovoltaics as emitters/absorbers and contribute to advancements in water-splitting for solar hydrogen production. In addition, we have observed optoelectronic tunability in oxygen-free TixAl1-xN thin films, achieved through compositional variations using molecular beam epitaxy. Furthermore, I am also focused on growing single-crystal Al/AlOx/Al and Al/AlNx/Al structures by MBE technique for the fabrication of Josephson junctions. These structures hold significant potential for applications in superconducting quantum bits.

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